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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/643,461

08/18/2003

Qi Xiang

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03/03/2005

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EXAMINER

NGUYEN, JOSEPH H

ART UNIT

PAPER NUMBER

2815

DATE MAILED: 03/03/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

# Office Action Summary

Application No.

10/643,461

Applicant(s)

XIANG ET AL.

Examiner

Joseph Nguyen

Art Unit

2815

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

## Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

## Status

- 1) ☒ Responsive to communication(s) filed on 22 December 2004.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

## Disposition of Claims

- 4) ☒ Claim(s) 1-3, 6, 7, 9, 10, 13, 15 and 19 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-3, 6, 7, 9, 10, 13, 15, 16 and 19 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

## Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 18 August 2003 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

## Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

## Attachment(s)

- |   |   |
|---|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)             | 4) <input type="checkbox"/> Interview Summary (PTO-413)                     |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)    | Paper No(s)/Mail Date. _____  |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| Paper No(s)/Mail Date _____   | 6) <input type="checkbox"/> Other: _____                                    |

## DETAILED ACTION

### *Claim Rejections - 35 USC § 102*

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

Claims 1-3, 6, 9-10, 15-16 are rejected under 35 U.S.C. 102(b) as being anticipated by Kubo et al.

Regarding claim 1, Kubo et al. discloses on figure 1 a FET situated over a substrate 10, said FET comprising a channel 14 situated in said substrate; a first gate dielectric 19 situated over said channel, said first gate dielectric having a first coefficient of thermal expansion; a first gate electrode 18 situated over said first gate dielectric, said first electrode having a second coefficient of thermal expansion; wherein said first gate dielectric and said first gate electrode are selected such that a difference between said second coefficient of thermal expansion and said first coefficient of thermal expansion causes an increase in carrier mobility in said FET

Note that the first gate dielectric is made of silicon oxide and the first gate electrode made of polysilicon. Therefore, the second coefficient of thermal expansion of

the first gate electrode is different than said first coefficient of thermal expansion of the first gate dielectric since the coefficient of thermal expansion depends on the material (see Exhibit A, Wolf et al.). Further, the phrase "causes an increase in carrier mobility in said FET" is merely functional language. The device of Kubo et al. herein would naturally cause an increase in carrier mobility due to the difference of coefficients of thermal expansion of poly-silicon and silicon oxide.

Regarding claim 2, Kubo et al. discloses that said second coefficient of thermal expansion is greater than said first coefficient of thermal expansion See Wolf et al.).

Regarding claim 3, Kubo et al. discloses on figure 1 said increase in said carrier mobility is caused by a tensile a tensile strain created in said channel 14.

Regarding claim 6, Kubo et al. discloses on figure 1 said FET is a PFET.

Regarding claims 9-10, 15 and 16, in the similar manners as the rejection of claims 1-3 and 6 above, Kubo et al. discloses on figure 1 all the structures set forth in the claims 9-10, 15 and 16.

### ***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 7, 13, 19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kubo et al. as applied to claims 1, 9 and 15 above.

Regarding claims 7, 13 and 19, Kubo et al. disclose on figure 1 substantially all the structure set forth in the claimed invention except said first coefficient of thermal expansion being greater than said second coefficient of thermal expansion. However, it would have been obvious to one having ordinary skill in the art at the time of the invention was made to modify Kubo et al. by having said first coefficient of thermal expansion being greater than said second coefficient of thermal expansion for the purpose of improving the performance of a FET device, since it has been held that discovering an optimum value of a result effective variable involves only routine skill in the art. In re Boesch, 617 F.2d 272, 205 USPQ 215 (CCPA 1980).

### ***Response to Arguments***

Applicant's arguments filed 12/22/2004 have been fully considered but they are not persuasive.

Applicant argues that Kubo et al. fails to disclose "a first gate dielectric and a first gate electrode being selected such that a difference between the second coefficient of thermal expansion of the first gate electrode and the first coefficient of thermal expansion of the first gate dielectric causes an increase in carrier mobility in the FET as recited in now amended claims 1, 9 and 15. However, as explained above in the rejection, the coefficient of thermal expansion depends upon the material (see Exhibit A, Wolf et al.). Since the first gate dielectric is made of silicon oxide and the first gate

electrode made of polysilicon in Kubo et al., the second coefficient of thermal expansion of the first gate electrode is different from said first coefficient of thermal expansion of the first gate dielectric. Further, the phrase "causes an increase in carrier mobility in said FET" is merely functional language. The device of Kubo et al. would cause an increase in carrier mobility due to the difference of coefficients of thermal expansion of poly-silicon and silicon oxide. Therefore, Kubo et al. clearly discloses all the structure set forth in the amended claims herein.

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the date of this final action.

**Conclusion**

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Joseph Nguyen whose telephone number is (571) 272-1734. The examiner can normally be reached on Monday-Friday, 7:30 am- 4:30 pm. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Tom Thomas can be reached on (571) 272-1664. The fax phone number for the organization where this application or proceeding is assigned is (703) 872-9306 for regular communications.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

JN  
February 23, 2005

  
ALLAN R. WILSON  
PRIMARY EXAMINER